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Let's Visit a Research Laboratory

INTRODUCTION AND LESSON PLANS

Let's Visit a Research Laboratory Lesson Plans

Many children go to their doctor regularly. Some have visited or stayed in a hospital. They know that doctors and nurses can offer treatment or give them medications that will make them feel better. By following the doctor's directions they will probably recover quickly and return to their life of school and play.

But how did the doctor know what was wrong with them? How did he know what illness or condition caused so much pain and discomfort? How did the doctor know what medicines or treatment would help? How did the doctor know what medicines were safe to prescribe? And why, with all these wonderful treatments, are there still times when doctors can't make people feel better?

Building on a child's personal knowledge and experience is one of the most effective ways of making science "come alive" for young people. By learning how scientists perform medical research in laboratories, children can better understand how and why doctors are able to help people to get well.

What does a laboratory look like? What does a scientist do in the laboratory? How do other people help scientists in their work? What materials and equipment do scientists need to conduct their investigations? How do animals help scientists in this work? The **Let's Visit A Research Laboratory** poster can provide you with helpful illustrations to answer these questions and for classroom discussion and activities.

Invite your students to explore a real research laboratory. How can you make your own classroom into a learning laboratory?

HE20.8002:

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Alcohol, Drug Abuse, and Mental Health Administration

ACTIVITY ONE

Topic:

All Laboratories Are Not Alike

Grade Level: 2-5

Background Information:
Not all laboratories look alike. In fact, not all scientific research is done in a laboratory. Some research is done outside, underground, in space, or underwater.

Problem:
How do laboratories differ from each other?

What do I want the children to discover?
Not all laboratories are alike. The materials and work that goes on in a laboratory depends on what the scientist wants to find out.

What will I need?
The **Let's Visit A Research Laboratory** poster, several illustrations of various laboratories and research type facilities, such as hospital labs, physics and chemistry labs, underwater exploration vehicles, space modules.

What will we discuss?
What is needed to make a laboratory? Why do scientists conduct research in laboratories? Why is this research important?

What will the children do?
Display the pictures around the classroom. Have the children list on the board the similarities and differences between the various laboratories. What activities go on that make this a laboratory? Discuss some of the materials and equipment found in each laboratory. For what purpose is that equipment used? What would the scientist do if he did not have those materials?

How will the children use or apply what they discovered?
1. Have the children use poster board to design their own laboratory. Include materials and equipment they will want in their lab. Encourage them to write out what type of research they might do in their lab.
2. Visit your local museum of science and industry. Encourage children to find illustrations and materials from various research facilities.
3. Invite a variety of researchers to visit your classroom to explain the type of research they do, where they conduct their research, and what kind of equipment they need to carry out their work.

ACTIVITY TWO

Topic:

Scientific Method

Grade Level: 2-5

Background Information:
Researchers conduct experiments by what is known as the scientific method. From reading and making observations, a scientist raises a question or sees a problem to be investigated. To find a solution, the scientist first develops a possible answer (hypothesis) to the question being investigated. Then he works out the detailed steps to prove or disprove the hypothesis. As a scientist conducts his experiment, he writes down everything he observes. The final step of the scientific method requires a scientist to read his data to decide if his question can now be answered.

Scientists must be able to repeat the work of other scientists to ensure that the findings are correct. Scientists also share their findings with others — at meetings, conventions and through publications — so that they can get help in answering difficult questions.

Problem:
Why is it necessary to keep records of experiments?

What do I want the children to discover?
Keeping accurate records of research is the key to good science. It also enables other scientists to evaluate the validity of experiments.

What will I need?
The **Let's Visit A Research Laboratory** poster and a variety of simple classroom experiments that can be conducted in one day or if preferable over a period of time. Such experiments can be found in science books at the library and scientific magazines for teachers (suggested bibliography included).

What will we discuss?
Ask the children to look closely at the poster and to list the various ways data are being recorded. What type of equipment or materials are being used? What can children use to accurately record classroom projects: pen and paper; charts and graphs; illustrations; a computer.

What will the children do?
Divide the children into small groups. Have each group conduct a different experiment. (If the experiment requires more than one day, allow space in the classroom for students to keep their projects.) Ask the children to record what they hoped to find out, the procedure they followed, the results of their experiment, and the conclusion they came to.

After the groups have performed one experiment, instruct them to perform a second experiment using another group's design.

Then ask the groups to share their findings for both experiments with the class. Discuss any different findings from the same experiment. How were the results the same? What may have caused any differences?

How will the children use or apply what they discovered?
Have the children write out a procedure to use in the classroom for setting up experiments and recording data. Have a poster made of the agreed process and post it in the classroom for easy reference for future experiments.

ACTIVITY THREE

Topic:

Laboratory Safety

Grade Level: 2-5

Background information:
In almost everything we do — playing sports, driving cars and bicycles, playing games — and nearly everywhere we go — school, work, the pool or the beach, rules are established for the safety of all and the good of the whole. Laboratory rules make for a safe environment for all the workers and ensure the quality of the work.

Problem:
How do rules help order our lives?

What do I want the children to discover?
Rules do not hinder discovery but provide for safe and successful discovery.

What will I need?
Samples of rules for various real life activities for children and for professional laboratories. (e.g., bicycle riding rules, swimming pool rules, driving rules, miniature golf rules, board game rules, etc.)

What will we discuss?
Ask the children why they think we have rules to follow in society.

What will the children do?
Divide the children into groups of three to five. Pass out various rules lists that you have gathered, and ask the children to read them over in their small groups and discuss why each rule is important for each specific activity. Discuss situations where rule violations could pose a problem.

If possible, post laboratory rules that you have gathered from various labs (e.g., x-ray, chemistry lab). Read over these rules and discuss the importance of each rule.

How will the children use or apply what they discovered?
The children can generate a list of safety rules for the classroom or school science laboratory in work groups. Share the rules generated from each work group and compile a final list of class rules for the laboratory. Have the children make posters of these rules and post them in the room.

Laboratory safety guidelines to consider:

- DON'T EAT OR DRINK FROM LABORATORY EQUIPMENT
- KEEP WORK AREA CLEAN
- WEAR PROTECTIVE EYE GOGGLES WHEN WORKING WITH CHEMICALS
- READ DIRECTIONS BEFORE OPERATING EQUIPMENT
- HANDLE LIVE ANIMALS WITH CARE

ACTIVITY FOUR

Topic:

Laboratory Animal Care

Grade Level: 2-5

Background information:
Many scientific investigations must be conducted on animals instead of people. People cannot live in laboratories for the long time it takes to conduct some experiments. More importantly, many scientific procedures and new medications cannot be given to humans until tests with laboratory animals have been done. Many scientists love animals and have pets of their own. They want to be sure their laboratory animals are as safe and comfortable as possible.

Problem:
How are animals cared for in laboratories?

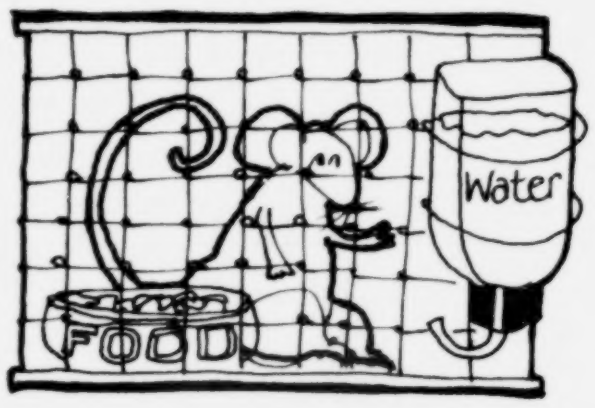
What do I want the children to discover?
Scientists want and need their animals to be healthy and safe. They do not want them to feel unnecessary pain. Also, unhealthy animals can jeopardize a research project. There are special guidelines that scientists must follow to be sure that their lab animals are safe.

What will I need?
The **Let's Visit A Research Laboratory** poster, samples of animal care guidelines from humane societies, pet shops, vets, zoos.

What will we discuss?
There are some basic needs all animals have. What must we be sure to do for our pet's health and well being in our homes? How are animals cared for in zoos and animal hospitals? How should animals be cared for in laboratories?

What will the children do?
Divide the children into small groups of three to five. Pass out paper and have the children list animal care guidelines for a zoo, animal shelter, laboratory, and house pet. Bring the groups together to share the rules with the class. How are the rules for each location the same and how are they different? Why is each rule important for the particular location?

How will the children use or apply what they discovered?
Have the class list rules for animal care in the classroom. Encourage children to bring animals in the classroom for scientific observation or arrange for an animal project that will last several weeks or months.



ACTIVITY FIVE

Topic:

Careers Related To Research

Grade Level: 2-5

Background information:
Career exploration needs to begin early in a child's education. Children should be made aware of the vast opportunities available to them. Professional and technical careers provide stimulating work and fill the projected job market need. Nationally, it is necessary to encourage and kindle natural inclinations toward science careers and, at the least, educate our students to be supporters of science for our country.

Problem:
How do we encourage scientific research as a career and/or a cause?

What do I want the children to discover?
Science offers many varied and viable career choices.

What will I need?
Trade books on various science fields and/or scientific contributors, "tools of the trade" from a variety of science and science related careers (microscope, test tubes, petri dishes, tuning forks, batteries, wire, measurement devices, etc.), and the **Let's Visit A Research Laboratory** poster.

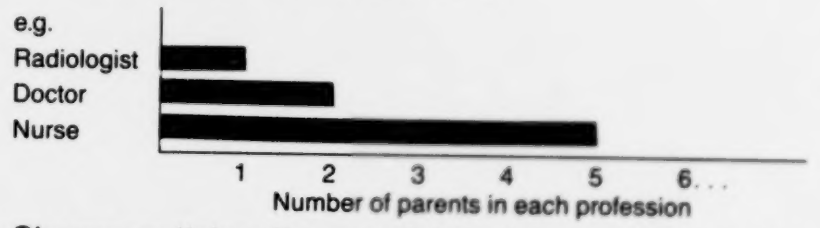
What will we discuss?
Each job has special "tools of the trade" to make the work more effective and efficient. What "tools of the trade" do teachers use? (Record the suggestions on the board under teacher.) What "tools of the trade" do carpenters use? Scientists? Etc. (Record.)

What will the children do?
Have the children list some of the "tools of the trade" found in the laboratory poster. Now generate a list of scientific fields that utilize these tools. Record on chart paper entitled "ologies" of science — zoology, biology, pathology, archeology, psychology, photography, agronomy, astronomy, hydrology, geology, cardiology, ophthalmology, radiology, etc.). Now classify these "ologies" according to: Science and Environment, Science and Health, Science and Industry, Science and Our Lives, Science and Technology, Science and Energy. Have the children generalize that science impacts every phase of our lives.

How will the children use or apply what they discovered?

1. Gather pictures for each category listed above and make a "web" of science.

2. Depending on student's family background, make a histogram of the scientific and technological careers in the families of the class members.



3. Choose an "ology," research it and develop a semantic map of the term.

term	definition	community examples	tools of the trade	training
a)				
b)				
c)				

4. Arrange to have some career scientists visit the classroom or have the children prepare interview questions for a scientist in the community and interview him/her on videotape and bring back to share with the class.

5. Check in your media center for filmstrips and/or films on specific careers in science and share these with the children.

6. Have children read bibliographies of some famous scientists and report their findings to the class. Have the children illustrate important discoveries made by scientists and display them in the class.

BIBLIOGRAPHY

Your school or local library contains many wonderful science books and magazines filled with simple classroom experiment ideas, bibliographies on famous scientists, the history of famous medical discoveries and much more. Some suggested books include:

- **Biology Experiments For Children**, Ethel Hanover, Dover Publications, Inc., New York, 1962.
- **Experiments With Animal Behavior**, Ovid K. Wong, Children's Press, Chicago, 1988.
- **Famous Experiments and How To Repeat Them**, Brent Filson, Julian Messner Publisher, New York, 1986.
- **How to Think Like A Scientist, Answering Questions by the Scientific Method**, Stephen P. Kramer, Thomas Y. Crowell Publishing, New York, 1987.
- **Mr. Wizard's Experiments for Young Scientists**, Don Herbert, Doubleday and Company, Inc., Garden City, NY, 1959.
- **Mr. Wizard's Supermarket Science**, Don Herbert, Random House, New York, 1980.
- **Microscope, How To Use It And Enjoy It**, Eve and Albert Stwertka, Julian Messner Publisher, NY, 1988.
- **Science Magic, Scientific Experiments for Young Children**, Alison Alexander and Susie Bower, Simon and Schuster Inc., New York, 1986.
- **What Can She Be? A Scientist**, Gloria & Ester Goldreich, Holt, Rinehart and Winston, New York, 1981.

LET'S VISIT A RESEARCH LABORATORY

ROOM 1. OFFICE

When visiting a laboratory it is important to first check in at the office. It is often like the principal's office or the office where many parents work.

A. A secretary works in the office and does many different jobs. She types, answers the telephone, and keeps records. A secretary may also greet visitors and tell them about the safety rules that must be followed when walking through a laboratory.

ROOM 2. LIBRARY

The library in a laboratory is probably much like the library in a school. Scientists often go to the library first when they have an idea to investigate or a problem to study. They read books, reports and magazines from all over the world to learn more about their idea or to find out if anyone else has already found a solution to the problem.

A. Sometimes visitors meet with scientists in the library. Scientists also use the library to meet and work together.

ROOM 3. COMPUTERS

Scientists use computers to gather, arrange and examine information, much as students do. Scientists can now do in days things on computers that would have taken many lifetimes to do with a pencil and paper.

A. This is a technician. A technician is a trained laboratory worker who helps scientists with their investigations and experiments.

B. These books contain journals and records of experiments. Instruction manuals explain how different equipment works.

ROOM 4. CULTURE LAB

In research laboratories, scientists sometimes work with groups of cells such as skin, muscle, and organ tissue to explore new cures or treatments for diseases.

A. This is a biochemist. He is a scientist who studies the chemicals in animals and other living things.

B. A fume or safety hood protects people from unsafe chemicals.

C. Beakers and flasks are used to mix and measure chemicals. Test tubes hold small amounts of chemicals for use in an experiment.

D. Cells from frog eggs are one example of tissue studied in a culture.

E. This is a pail of dry ice. Dry ice is colder than regular ice. It is used to freeze tissue and cell samples for scientists to use at a later date.

ROOM 5. KITCHEN/ LAUNDRY

A kitchen and laundry is needed in a laboratory for the same reason you need one at home or school. Just as it's important for your family's health and safety to keep everything clean and neat, it's also important in a laboratory.

A. The lab coats that scientists wear are often washed in the laboratory laundry. The gloves and masks that they wear are thrown away after being worn once.

B. The scientists and other laboratory workers can get coffee or store their lunches in the kitchen.

ROOM 6. RESEARCH LAB

Most rooms in a research building are laboratories where actual experiments are conducted. Basic laboratory equipment is kept and used in places just like this one.

A. This is a pharmacologist. She is a scientist who studies how drugs affect humans.

B. A research assistant is often a student who wants to become a scientist. He learns about science by helping and watching a scientist at work in a real laboratory.

C. Some chemicals can be washed out of test tubes, beakers and other laboratory equipment in an ordinary sink. But dangerous or toxic chemicals must not be poured down the sink. They can be placed in special containers marked with hazard signs.

D. This refrigerator is not used to store food. Instead, it is used to store tissues or chemicals which must be kept cold.

E. Scientists can learn more about why humans do certain things by watching how well mice and rats solve problems in a maze or puzzle.

F. Many things scientists need to look at are too small to see clearly. Looking through a microscope makes small objects big enough for scientists to see.

ROOM 7. TESTING LAB

Scientists also study animals closely related to humans, such as monkeys. Some monkeys are trained to do activities much like video games which are actually experiments. They usually work in a room of their own so as not to be disturbed.

A. This is a neuroscientist. He is a scientist who studies how drugs affect the brain.

B. When animals are needed in an experiment, scientists want to learn more often use mice or rats. When scientists want to learn more about the human brain they often work with monkeys because the brains of monkeys are very much like the brains of humans.

C. Special chairs are made for the monkeys that allow them to see the TV monitor and move about comfortably, but keep them from running around the room.

D. Monkeys solve problems while looking at TV monitors. These monitors are connected to computers that record the monkey's answers which scientists will study later.

E. Sometimes video cameras are used to keep track of the monkey's actions.

ROOM 8. TREATMENT

Most laboratories have a room just like a doctor's office to care for animals if they become ill or get injured. Just like kids, monkeys can play rough and sometimes bite one another. They need treatment for cuts and scrapes.

A. This is a veterinarian. He works at the laboratory and treats sick or injured animals.

B. When people work with animals they wear lab coats, masks, and gloves to prevent the spread of any germs between humans and animals.

C. Just as in a doctor's office, there are cupboards to store medicines, ointments and creams that the veterinarian will need when treating the animals.

D. Like humans, monkeys are not always happy to be in a doctor's office.

ROOM 9. NURSERY

Baby monkeys are kept in a nursery which is somewhat like a daycare center.

A. This is a nurse. He watches over the young monkeys to be sure they are healthy and comfortable.

B. Very young monkeys get cold easily and need to stay in specially heated, covered beds called incubators. These incubators are similar to those used in hospitals for human infants. Incubators keep monkeys warm until their fur grows in.

C. Monkeys live in clean, comfortable cages big enough for them to play in. Just like children, monkeys like to play with toys, hold blankets or towels, and swing on ropes.

ROOM 10. RO[illegible] HOU[illegible]SING

All animals in the [illegible] provided proper shelter [illegible] cages such as these are [illegible] part of an experiment. Scientists easily watch how well they [illegible] Many laboratories raise mice [illegible] and mice in similar cages.

A. This is a physiologist. [illegible] scientist that studies all the [illegible] processes of an organism.

B. In some experiments [illegible] more must be protected [illegible] germs that might be in the [illegible] Clear plastic tent covers make a set of cages. Under it a machine called a flowhood blows [illegible] air.

ROOM 11. SUPPLIES/ STORAGE

All food for laboratory animals is kept in a separate room and stored properly to be sure it stays fresh.

A. Animals are fed nutritious foods. Rats, mostly eat rat pellets but monkeys like to have fruits and special treats with their monkey chow. Some monkeys even enjoy popsicles served in cups.

ROOM 12. CAGE WASHER

A. This is an animal care worker. He is one of the many people who is trained to help scientists take care of the animals. Animal care workers check to be sure the animals are healthy, clean the cages, feed the animals and often play with them.

B. Entire cages can be washed in special machines. Just like a kitchen dishwasher this machine sterilizes what it cleans.

ROOM 13. MONKEY HOUSING

Every effort is made to safeguard the well-being of laboratory monkeys.

A. This is an ethologist or behavioral scientist. She is a scientist who tries to learn more about why animals act in certain ways. For example, how do female monkeys learn how to be good mothers.

B. Some laboratories have space for monkeys to play outside. Video cameras may be used to record the monkey's activities.